

IN THE CLAIMS

We claim:

1. A method of cleaning a molybdenum mask having a series of metals deposited thereon, comprising:

placing the molybdenum mask in a cleaning solution including hydrochloric acid; and

removing the molybdenum mask from the cleaning solution after a predetermined period of time.

2. The method of claim 1, further comprising:

agitating the cleaning solution at a predetermined agitation level for a predetermined period of time.

3. The method of claim 2, further comprising:

putting the molybdenum mask in a container; and wherein placing the molybdenum mask in the cleaning solution includes placing the container in the cleaning solution.

4. The method of claim 3, further comprising:

closing the container.

5. The method of claim 4, wherein:

the cleaning solution is contained within a first vessel;

the first vessel is contained within a second vessel; and

the second vessel further contains an aqueous solution surrounding the first vessel.

6. The method of claim 5, further comprising:
covering the first vessel with a lid.
7. The method of claim 6, further comprising:
drying the mask with nitrogen.
8. The method of claim 7, further comprising:
washing the mask with de-ionized water.
9. The method of claim 8, wherein:
the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 5 percent.
10. The method of claim 9, wherein:
the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 15 percent.
11. The method of claim 10, wherein:
the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 25 percent and no more than 50 percent.

12. The method of claim 11, wherein:
the cleaning solution is a hydrochloric acid solution having an acid concentration of about 37 percent.
13. The method of claim 8, wherein:
the predetermined period of time is at least 5 minutes and no more than 300 minutes.
14. The method of claim 13, wherein:
the predetermined period of time is at least 10 minutes and no more than 100 minutes.
15. The method of claim 14, wherein:
the predetermined period of time is at least 15 minutes and no more than 40 minutes.
16. The method of claim 15, wherein:
the predetermined period of time is at least 25 minutes and no more than 30 minutes.
17. The method of claim 8, wherein:
the agitation level is quantified in terms of agitation frequency.
18. The method of claim 17, wherein:
the agitation frequency is between 18 kHz and 2 MHz.

19. The method of claim 18, wherein:
the agitation frequency is between 20 kHz and 1 MHz.
20. The method of claim 19, wherein:
the agitation frequency is between 20 kHz and 100 kHz.
21. The method of claim 20, wherein:
the agitation frequency is between 25 kHz and 50 kHz.
22. The method of claim 8, wherein:
the agitation level is quantified in terms of agitation power.
23. The method of claim 22, wherein:
the agitation power is between 1 W/gal and 100 W/gal.
24. The method of claim 23, wherein:
the agitation power is between 2 W/gal and 50 W/gal.
25. The method of claim 24, wherein:
the agitation power is between 5 W/gal and 40 W/gal.
26. The method of claim 25, wherein:
the agitation power is between 10 W/gal and 30 W/gal.
27. The method of claim 26, wherein:
the agitation power is between 20 W/gal and 30 W/gal.

28. The method of claim 27, wherein:
the agitation power is about 25 W/gal.
29. The method of claim 1, wherein:
the predetermined period of time is at least 5 hours and no more than 48 hours.
30. The method of claim 1, wherein:
the molybdenum mask has a set of through holes.
31. The method of claim 1, wherein:
the series of metals includes chrome, copper, gold and a lead/tin mixture.
32. A method of cleaning a mask, comprising:
placing the mask in a cleaning solution; and
agitating the cleaning solution at a predetermined agitation level for a predetermined period of time.
33. The method of claim 32, further comprising:
putting the mask in a container; and wherein
placing the mask in the cleaning solution includes placing the container in the cleaning solution.
34. The method of claim 33, further comprising:
closing the container.

35. The method of claim 34, further comprising:
receiving the mask.
36. The method of claim 32, wherein:
the mask is a molybdenum mask.
37. The method of claim 32, wherein:
the cleaning solution is a hydrochloric acid solution.
38. The method of claim 37, wherein:
the cleaning solution is contained within a first vessel;
the first vessel is contained within a second vessel; and
the second vessel further contains an aqueous solution surrounding the
first vessel.
39. The method of claim 38, further comprising:
covering the first vessel with a lid.
40. The method of claim 37, further comprising:
drying the mask with nitrogen.
41. The method of claim 40, further comprising:
washing the mask with de-ionized water.

42. The method of claim 37, wherein:
- the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 5 percent.
43. The method of claim 42, wherein:
- the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 15 percent.
44. The method of claim 43, wherein:
- the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 25 percent and no more than 50 percent.
45. The method of claim 44, wherein:
- the cleaning solution is a hydrochloric acid solution having an acid concentration of about 37 percent.
46. The method of claim 37, wherein:
- the predetermined period of time is at least 5 minutes and no more than 300 minutes.
47. The method of claim 46, wherein:
- the predetermined period of time is at least 10 minutes and no more than 100 minutes.

48. The method of claim 47, wherein:
the predetermined period of time is at least 15 minutes and no more than 40 minutes.
49. The method of claim 48, wherein:
the predetermined period of time is at least 25 minutes and no more than 30 minutes.
50. The method of claim 46, wherein:
the predetermined period of time is at least 10 minutes and no more than 100 minutes.
51. The method of claim 37, wherein:
the agitation level is quantified in terms of agitation frequency.
52. The method of claim 51, wherein:
the agitation frequency is between 18 kHz and 2 MHz.
53. The method of claim 52, wherein:
the agitation frequency is between 20 kHz and 1 MHz.
54. The method of claim 53, wherein:
the agitation frequency is between 20 kHz and 100 kHz.
55. The method of claim 54, wherein:
the agitation frequency is between 25 kHz and 50 kHz.

56. The method of claim 55, wherein:
the agitation frequency is between 25 kHz and 40 kHz.
57. The method of claim 37, wherein:
the agitation level is quantified in terms of agitation power.
58. The method of claim 57, wherein:
the agitation power is between 1 W/gal and 100 W/gal.
59. The method of claim 58, wherein:
the agitation power is between 2 W/gal and 50 W/gal.
60. The method of claim 59, wherein:
the agitation power is between 5 W/gal and 40 W/gal.
61. The method of claim 60, wherein:
the agitation power is between 10 W/gal and 30 W/gal.
62. The method of claim 61, wherein:
the agitation power is between 20 W/gal and 30 W/gal.
63. The method of claim 57, wherein:
the agitation power is about 25 W/gal.
64. The method of claim 37, wherein:
the container is made of Teflon®.

65. The method of claim 37, wherein:
the container is made of a material essentially inert with respect to hydrochloric acid.
66. The method of claim 37, wherein:
the container is made of high-density polyethylene.
67. The method of claim 37, wherein:
the method is performed within an environment having a temperature between 20 °C and 70 °C.
68. The method of claim 67, wherein:
the method is performed within an environment having a temperature between 20 °C and 50 °C.
69. The method of claim 68, wherein:
the method is performed within an environment having a temperature between 25 °C and 40 °C.
70. The method of claim 68, wherein:
the method is performed within an environment having a temperature of about 25 °C.

71. The method of claim 68, wherein:
- the method is performed within an environment having a temperature of about 30 °C.
72. The method of claim 68, wherein:
- the method is performed within an environment having a temperature of about 40 °C.
73. A method of cleaning a mask, comprising:
- putting the mask in a container;
- placing the container in a cleaning solution; and wherein
- the cleaning solution is contained within a first vessel;
- the first vessel is contained within a second vessel; and
- the second vessel further contains an aqueous solution surrounding the first vessel.
74. The method of claim 73, further comprising:
- closing the container.
75. The method of claim 74, further comprising:
- covering the first vessel with a lid.
76. The method of claim 75, further comprising:
- washing the mask with de-ionized water.

77. The method of claim 76, further comprising:
drying the mask with nitrogen.
78. The method of claim 77, further comprising:
receiving the mask.
79. The method of claim 73, wherein:
the cleaning solution is a hydrochloric acid solution.
80. The method of claim 79, wherein:
the mask is a molybdenum mask.
81. The method of claim 75, further comprising:
agitating the cleaning solution.
82. An apparatus for cleaning masks, comprising:
a first vessel having an open top;
a second vessel having an open top, the second vessel containing the first
vessel; and
an agitator within the second vessel.
83. The apparatus of claim 82, further comprising:
an aqueous solution within the second vessel; and
a cleaning solution within the first vessel.

84. The apparatus of claim 83, further comprising:
a lid sized to cover the open top of the first vessel.
85. The apparatus of claim 83, further comprising:
a relatively inert container sized to hold a plurality of masks and sized to fit within the first vessel.
86. The apparatus of claim 85, wherein:
the container has a clamshell form.
87. The apparatus of claim 85, wherein:
the container has a container vessel with an open top and a container lid sized to cover the open top of the container vessel.
88. The apparatus of claim 83, wherein:
the cleaning solution is an acid.
89. The apparatus of claim 88, wherein:
the cleaning solution is hydrochloric acid.
90. The apparatus of claim 83, wherein:
the cleaning solution is a base.
91. The apparatus of claim 90, wherein:
the cleaning solution is sodium hydroxide.

92. An apparatus for cleaning masks, comprising:
- a first means for cleaning the masks;
 - a second means for holding the masks;
 - a third means for agitating the first means and the second means;
 - a fourth means for containing the first means;
 - a fifth means for surrounding the fourth means; and
 - a sixth means for holding the fifth means and the third means.
93. A method of cleaning a molybdenum mask having a series of metals deposited thereon, comprising:
- placing the molybdenum mask in a cleaning solution; and
 - removing the molybdenum mask from the cleaning solution after a predetermined period of time.
94. The method of claim 93, further comprising:
- agitating the cleaning solution at a predetermined agitation level for a predetermined period of time.
95. The method of claim 94, further comprising:
- putting the molybdenum mask in a container; and wherein
 - placing the molybdenum mask in the cleaning solution includes placing the container in the cleaning solution.

96. The method of claim 95, further comprising:
closing the container.
97. The method of claim 96, further comprising:
receiving the mask.
98. The method of claim 93, wherein:
the cleaning solution is a hydrochloric acid solution.
99. The method of claim 98, wherein:
the cleaning solution is contained within a first vessel;
the first vessel is contained within a second vessel; and
the second vessel further contains an aqueous solution surrounding the
first vessel.
100. The method of claim 99, further comprising:
covering the first vessel with a lid.
101. The method of claim 100, further comprising:
drying the mask with nitrogen.
102. The method of claim 101, further comprising:
washing the mask with de-ionized water.

103. The method of claim 98, wherein:
- the cleaning solution is a hydrochloric acid solution having an acid concentration of at least 5 percent.
104. The method of claim 93, wherein:
- the series of metals includes chrome, copper, gold and a lead/tin mixture.
105. A method of cleaning a molybdenum mask having a series of metals including chrome, copper, gold and a lead/tin mixture deposited thereon, comprising:
- placing the molybdenum mask in a cleaning solution; and
- removing the molybdenum mask from the cleaning solution after a predetermined period of time.
106. The method of claim 105, further comprising:
- agitating the cleaning solution at a predetermined agitation level for a predetermined period of time.
107. The method of claim 106, further comprising:
- putting the molybdenum mask in a container; and wherein
- placing the molybdenum mask in the cleaning solution includes placing the container in the cleaning solution.
108. The method of claim 107, further comprising:
- receiving the mask.

109. The method of claim 105, wherein:
the cleaning solution is a hydrochloric acid solution.
110. The method of claim 109, wherein:
the cleaning solution is contained within a first vessel;
the first vessel is contained within a second vessel; and
the second vessel further contains an aqueous solution surrounding the
first vessel.
111. The method of claim 110, further comprising:
covering the first vessel with a lid.
112. The method of claim 111, further comprising:
drying the mask with nitrogen.
113. The method of claim 112, further comprising:
washing the mask with de-ionized water.
114. The method of claim 105, wherein:
the cleaning solution is a hydrochloric acid solution having an acid
concentration of at least 5 percent.
115. The method of claim 113, wherein:
the cleaning solution is a hydrochloric acid solution having an acid concentration of at
least 5 percent.